

Claims:

1. A method of humidifying a process gas stream, the method comprising;
 - (a) humidifying the process gas stream at a first temperature so as to provide the process gas stream with excess humidity;
 - (b) cooling the process gas stream at a second temperature, lower than the first temperature, to cause condensation of excess moisture;
 - (c) removing excess condensed moisture from the process gas stream; and
 - (d) delivering the process gas stream at a known temperature, whereby the absolute humidity level in the process gas stream is determined from the maximum relative humidity at the second temperature.
2. A method as claimed in claim 1, wherein step (d) includes heating the process gas stream to a third temperature greater than the second temperature.
3. A method as claimed in claim 2, which includes humidifying the process gas stream in step (a) by injecting steam into the process gas stream.
4. A method as claimed in claim 3, which includes injecting steam into the gas stream in an amount sufficient to supersaturate the process gas stream.
5. A method as claimed in claim 2, which further comprises the step of supplying the humidified process gas stream at the third temperature to a fuel cell, and maintaining the third temperature of the process gas stream from step (d) at the third temperature, until the process gas stream reaches the inlet of a fuel cell.

6. A method as claimed in claim 5, which includes maintaining the third temperature of the process gas stream, by delivering the process gas stream through a supply line, and providing a heating element extending along the supply line.

7. A method as claimed in claim 2, wherein the first temperature is in the range 10 °C to 120 °C.

8. A method as claimed in claim 7, wherein the second temperature is in the range 5 °C to 115 °C.

9. A method as claimed in claim 8, wherein the third temperature is in the range 10 °C to 120 °C, and wherein the relative humidity of the process gas stream at the third temperature is in the range of 0 to 100%.

10. An apparatus for humidifying a process gas stream, for a fuel cell, the apparatus comprising:

a humidification unit having an inlet for the process gas stream, for adding humidity to the process gas stream at a first temperature, to a humidity well in excess of a required humidity level;

a first heat exchanger connected to the humidification unit, for cooling the process gas stream to a second, lower temperature, whereby excess moisture in the process gas stream condenses, and for removing the condensed moisture, whereby the process gas stream leaving the heat exchanger has a known temperature and a known humidity level.

11. An apparatus as claimed in claim 10, which includes a first heater connected to the first heat exchanger, for heating the process gas stream to a third temperature, greater than the second temperature, whereby the process gas stream has a known absolute humidity level.

12. An apparatus as claimed in claim 11, wherein the humidification unit includes a steam injector for injecting steam into the process gas stream.

13. An apparatus as claimed in claim 11, which includes an outlet line connected to the first heater and an elongate heating means provided for the outlet line, for maintaining the outlet line at the third temperature.

14. An apparatus as claimed in claim 13, where the elongate heating means comprises elongate electrical heating elements.

15. An apparatus as claimed in claim 11, which includes a separator, for removing the condensed moisture, provided between the first heat exchanger and the first heater.

16. An apparatus as claimed in claim 11, wherein the first heat exchanger includes a first temperature control circuit, for controlling the temperature of the heat exchanger, the first temperature control circuit comprising a conduit for a fluid, a pump for pumping the fluid, and means for cooling the fluid.

17. An apparatus as claimed in claim 16, wherein the first cooling circuit additionally includes a further heater for heating the fluid.

18. An apparatus as claimed in claim 11 or 16, wherein the first heater comprises a second heat exchanger, and wherein the second heat exchanger is provided with a second temperature control circuit for controlling the temperature of the second heat exchanger, the second temperature control circuit comprising a conduit for fluid, a pump for circulating the fluid and a third heater for heating the fluid.

THIS PAGE BLANK (USPTO)